

# Percé, Québec, Canada

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## Synopsis

The Ordovician–Silurian boundary in the Percé area occurs within the Matapédia Group. This boundary has not been identified within the Grande Coupe beds, which yield a brachiopod and trilobite fauna with pronounced northwestern European affinities. The Ordovician–Silurian boundary can, however, be recognized within the White Head Formation. The Côte de la Surprise Member is Hirnantian and yields both *Hirnantia* and *Mucronaspis* Communities. The overlying L'Irlande Member is presumed to be totally Silurian, but its basal part has not been positively dated.

## Introduction

Southeastern Québec is unique within the North American continent in that it contains two complete sequences near and at the Ordovician–Silurian boundary. A flat-lying sequence of diverse limestones occurs on Anticosti Island (Barnes, this volume), which was originally deposited in a shallow open-marine platform. The Percé sequence is also predominantly limestones, but is decidedly a deeper-platform deposit. This Percé sequence lies within the Appalachian folded belt, at the eastern end of the Aroostook–Percé Anticlinorium, which can be followed from central Maine (USA) to Percé (Ayrton *et al.* 1969), a distance of approximately 500 km. The Aroostook–Percé Anticlinorium in Québec, that is, in Gaspé, lies between the Siluro–Devonian Gaspé–Connecticut River Synclinorium to the north and the Baie des Chaleurs Synclinorium to the south. The Percé area is the most fossiliferous area within the Aroostook–Percé Anticlinorium and, furthermore, the lithostratigraphy there outlined is useful throughout Québec. Thus Percé stands as a local standard for the afore-mentioned anticlinorium.

The Anticosti platform, or the lateral equivalents of it, was probably the source of the carbonates for the Percé sequence. Brachiopods and trilobites are predominantly endemic to each sequence, although corals, conodonts, and ostracodes share some species. Ecological control of these faunas thus appears evident. The Ordovician faunas of the Anticosti and Percé sequences have different faunal affinities: the Anticosti sequence is related to the North American faunas, whereas the Percé faunas have a distinct northwestern European affinity, first recognized by Schuchert & Cooper (1930).

The recognition of the Ordovician–Silurian boundary on Anticosti and around Percé has been treated in detail by Lespérance (1985). A lithostratigraphical and palaeoecological revision of the Early Ashgill to Late Llandovery strata of the Matapédia Group of the Percé area is to be found in Lespérance *et al.* (1987). The lithostratigraphical revision follows the outlines given by Skidmore & Lespérance (1981), while the palaeoecological treatment, relying on the community framework of Boucot (1975), is entirely new. The present contribution will summarize data from Lespérance *et al.* (1981), Lespérance (1985), and Lespérance *et al.* (1987), but will also draw from other sources and unpublished data.

## Lithostratigraphical framework

The Aroostook–Percé Anticlinorium in Québec is composed of two main lithostratigraphical sequences: a predominantly carbonate suite termed the Matapédia Group, and a deeper-water, largely turbiditic suite termed the Honorat Group. The Taconic orogeny affected this part of the Appalachians, apparently culminating in the early Caradoc; both the Honorat and Matapédia Groups are younger than early Caradoc. The Honorat does not range into the Silurian (although about a dozen Hirnantian brachiopod localities are known), but the Matapédia

Group is as young as upper Telychian, on the basis of the conodont *Aulacognathus bullatus* (Nicoll & Rexroad 1969) (as reported by Nowlan 1983), present in the Des Jean Member of the White Head Formation in the Percé area.

Within the immediate vicinity of Percé (Skidmore & Lespérance 1981; Lespérance *et al.* 1987) strata of the Matapédia Group occur in two distinct structural bands. The northeast band is structurally complex, enough so that its total thickness is unknown. It is composed of locally varying proportions of calcilutites and shales, with rare calcarenites, predominantly pelmatozoan-bearing. This northeast band is in fault contact with Cambrian strata to the southwest. The exact lithostratigraphical correlation of these beds with the southwest band (the White Head Formation) is uncertain, which is the main reason why the northeast band of strata has been termed the Grande Coupe beds. Some non-limey shales occur along the sea at Grande Coupe (stream); these have been assigned to the (undivided) Honorat Group, but otherwise, all the Ordovician-Silurian strata of the Percé area are assigned to the Matapédia Group.

The southwest structural band of the Percé area lies with angular unconformity on Cambrian strata. This band is a monoclinical sequence of Ashgill to Llandovery strata which, in turn, are unconformably overlain by the Carboniferous Bonaventure Formation. The lower part of this band is composed of calcareous terrigenous strata and is assigned to the Rouge Member of the Pabos Formation. Above these are limestones, with minor intercalations of fine-grained terrigenous strata, which terminate along the sea at White Head (Cap Blanc); these strata are properly named the White Head Formation. Usage of the term White Head Formation before Skidmore & Lespérance (1981) included the Grande Coupe beds and the Rouge Member of the Pabos Formation, so that care in interpreting previous faunal lists must be exercised.

The stratotypes of the Rouge Member, as well as the four members of the White Head Formation, are all within 6 km of Percé, so that Fig. 1 is representative of the overall stratigraphy. The Rouge Member of the Pabos Formation consists of basal conglomeratic strata and coarse-grained sandstones, followed upward by mud-shales, sandstones, calcarenites, sandy limestones and calcilutites. Terrigenous content decreases upward, and when it reaches less than 50%, this signals the beginning of the White Head Formation.

The basal member of the White Head Formation consists of interbedded thinly bedded calcilutites with thinner interbeds of mudstones, with some calcarenites; these strata form the Birmingham Member. The next member, the Côte de la Surprise, is very predominantly dark green readily-weathering calcareous mudstone. The L'Irlande Member, composed of thin to medium bedded calcilutites and common very thinly bedded mud-shales, as well as rare thin-bedded calcarenites, overlies the Côte de la Surprise Member. Within the middle part of this member are significant clay-shale horizons. The youngest member of the White Head Formation, the Des Jean Member, does not crop out along the type section of the White Head Formation along the sea, and is composed of argillaceous calcilutites, with minor silty and sandy limestones, calcarenites and limestone conglomerates, in fine to very thick beds. The Grande Coupe beds are Ashgill, the Côte de la Surprise Member Hirnantian, and the L'Irlande Member Llandovery. A geological map of the Percé area will be found in Lespérance *et al.* (1987).

### Biostratigraphy

Brachiopod-dominated communities, assigned to Benthic Assemblage 4 or 5 (Boucot 1975), dominate the Rouge Member of the Pabos Formation. Extensive brachiopod and trilobite faunas are known from this member (Sheehan & Lespérance 1979), but it is notable that cyclopygid trilobites, as well as the trilobites *Calyptaulax* and *Lonchodomas*, are absent from this member, while *Stenopareia* and *Tretaspis*, on the other hand, are rare; this is in striking contrast with the partly coeval Grande Coupe beds. From a study of encrinurid trilobites, Lespérance & Tripp (1985) suggested that the age of this member was probably Cautleyan.

The Birmingham Member of the White Head Formation is also dominated by brachiopods, which are locally abundant, but their study is difficult because of their preservation in calcilu-

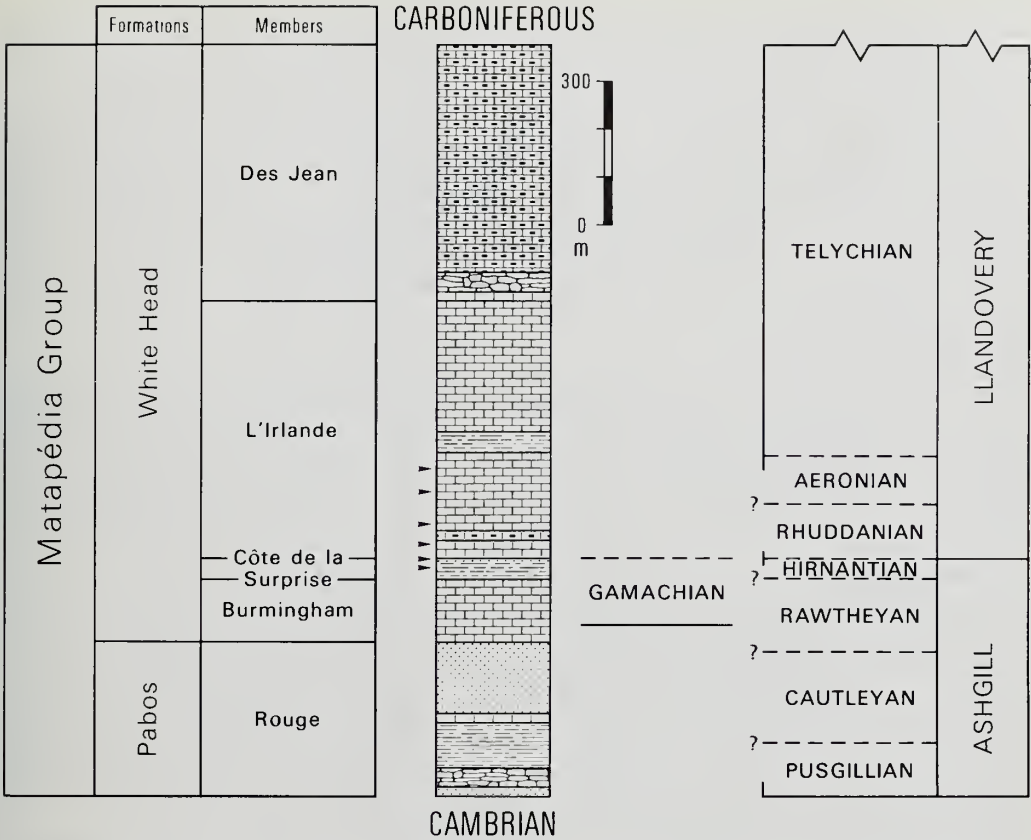


Fig. 1 Columnar section of the Pabos and White Head Formations in the Percé area, as taken from the type sections of the various members (covered intervals within type sections filled in by data from adjacent sections). The fossil localities shown within the L'Irlande Member occur along the sea at White Head, where its thickness below the central clay-shale unit is 22m greater than the one shown for its type section along the Deuxième Rang section. Compiled from data in Lespérance *et al.* (1987). Symbols as in Fig. 2.

tites. Only four trilobite species are known from this member, but corals are present (Bolton 1980). The base of the Gamachian Stage (from Anticosti) is drawn 34 m above the base of this 130 m thick member along the shore at White Head, its stratotype (Lespérance 1985: 841). A Benthic Assemblage 4 has been assigned to this member.

The Des Jean Member fauna is sparsely distributed and dominated by trilobites, notably *Acernaspis* (*Acernaspis*) *primaeva* (Clarke 1908) and *Stenopareia* sp., with infrequent brachiopods. Study of the Des Jean Member and the underlying L'Irlande Member brachiopods is hampered by the preservation in calcilitites and/or calcarenites, and thus most identifications are only precise at the familial level. Nonetheless, these two members have in common *Eospirifer*, a new atrypacid genus and a new athyridacid genus, as well as *Eoplectodonta* cf. *striatocostatus* (Twenhofel 1928); all but the first of these taxa are illustrated in Sheehan & Lespérance (1981: pl. 1). *Oxoplecia* sp. and *Atrypa* sp. are present, but restricted to the Des Jean Member (Lespérance & Sheehan 1981).

**Grande Coupe beds**

The fauna from the Grande Coupe beds is the best-known fauna from the Percé area, and is the

one with the striking northwestern European faunal affinity. No less than 45 different trilobites, 20 brachiopods and 22 cephalopods, to name but these, are known from these beds. The Priest's Road, Grande Coupe and southern flank of Mont Joli (Cooper & Kindle 1936) are its most fossiliferous localities. *Stenopareia perceensis* (Cooper in Schuchert & Cooper 1930) [= CSC] and cyclopygid trilobites are abundant, as are locally *Tretaspis clarkei* CSC, *Lonchodomas longirostris* CSC, and the brachiopods *Glyptorthis sublamellosa* CSC, *Sowerbyella gigantea* CSC, *Holtedahlina parva* CSC and *Christiania dubia* CSC. A Benthic Assemblage 6 position is indicated, but with local accumulations of pelagic taxa (cyclopygid trilobites and cephalopods), the *Foliomena* Community (Sheehan & Lespérance 1978), or Benthic Assemblage 4 storm deposits (yielding, notably, colonial corals with encrusted algae).

Hirnantian faunas, or for that matter Silurian faunas, have not been recognized within the Grande Coupe beds.

### Côte de la Surprise Member

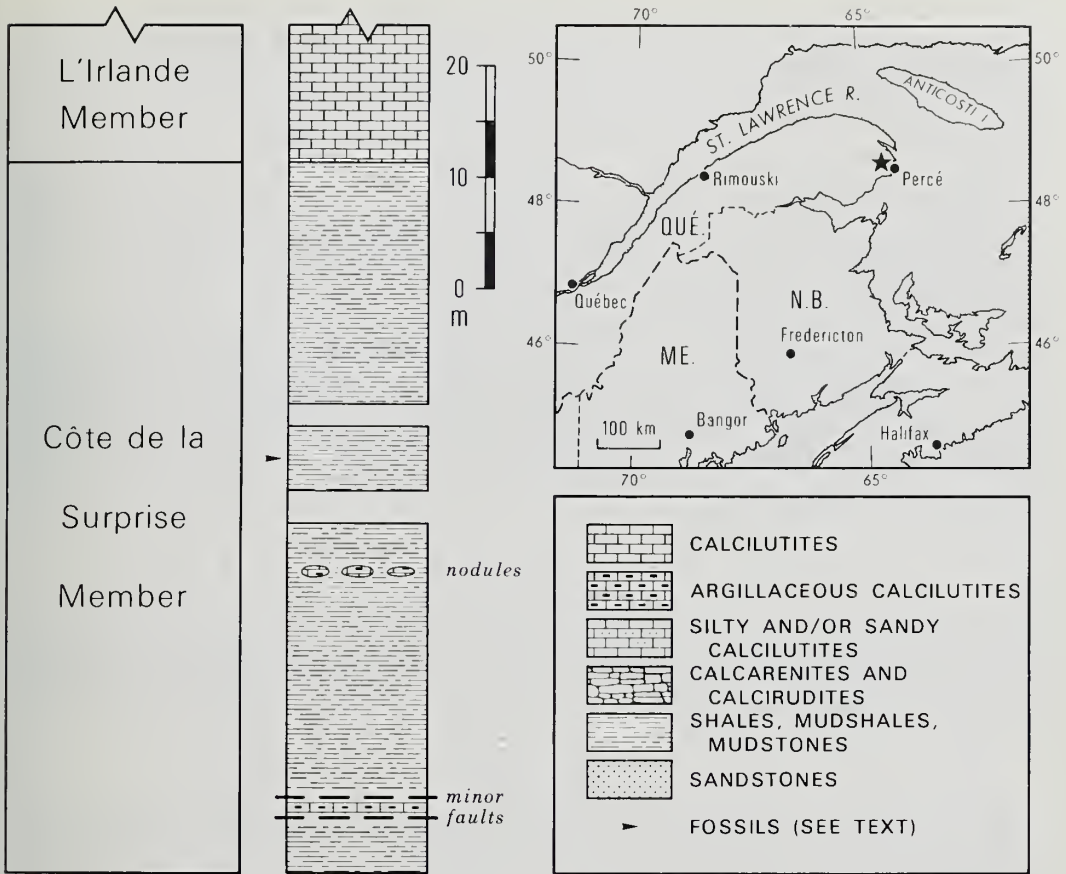
The stratotype of this member is along the sea at White Head. From a talus slope, approximately in the middle of the member, Lespérance & Sheehan (1976) described the brachiopods and listed other elements present in this fauna: *Dalmanella?* sp., *Eostropheodonta siluriana* (Davidson 1871), *Hirnantia sagittifera* (M'Coy 1851), *Kinnella kielanae* (Temple 1965), *Plectothyrella crassicosta* (Dalman 1828), rare *Phillipsinella parabola* s.l. (Barrande 1846), one pygidium of *Mucronaspis mucronata* (Brongniart 1822), and favositid, cornulitid, conulariid and pelmatozoan taxa. This fauna is a typical *Hirnantia* Community fauna, and assigned a Benthic Assemblage 4 position.

The contact between the Côte de la Surprise Member and the L'Irlande Member is faulted along the sea, and a boundary stratotype has been suggested along the adjacent Deuxième Rang [= Flynn road, Irishtown road] section, where the contact is undisturbed. Here, the uppermost 3 m of the 44 m thick Côte de la Surprise Member is composed of quartz arenites, and these have yielded (Lespérance & Sheehan 1981; Sheehan & Lespérance 1981) abundant brachiopods: an inarticulate, *Dalmanella testudinaria* (Dalman 1828), *Hirnantia sagittifera*, *Kinnella kielanae*, *Eostropheodonta siluriana*, *Plectothyrella crassicosta*, *P. n. sp.*, and *Hindella?* sp. (*Hindella*, however, is locally abundant in the Honorat Group west of Percé). This has been assigned a Benthic Assemblage possibly transitional between 3 and 4.

The Côte de la Surprise Member also crops out 17 km west-northwest of Percé (Lespérance 1974; Skidmore & Lespérance 1981) (Fig. 2). The fauna there consists almost entirely of trilobites, with some graptolites, and is a typical Benthic Assemblage 6 fauna. The horizon with the most fossils is between the two covered intervals of Fig. 2; fossils have not been recovered above the uppermost covered interval, nor in the overlying L'Irlande Member. Revision of all previous faunal lists now indicates the presence of: *Brongniartella robusta* (Lespérance 1968), *Cryptolithus portageensis* sp. nov. Lespérance (this volume, p. 370), *Mucronaspis mucronata*, *M. olini* (Temple, 1956), the sponge *Astylospongia praemorsa* (Goldfuss, 1826), a lingulid and a pholidostrophid brachiopod, a bivalve, and the graptolites *Climacograptus normalis* s.s. Lapworth (1877) (J. Riva, personal communication, 1984), and *Orthograptus* sp. This is considered a *Mucronaspis* Community; the presence of graptolites suggests nearness to pelagic (graptolite and other) communities.

### L'Irlande Member

Sparsely distributed, often isolated, trilobites and brachiopods occur in the upper three-quarters of the L'Irlande Member, but they are abundant only in infrequent calcarenite beds, often associated with ostracodes. Trilobites are the most abundant taxa in the member, and more specifically *Acernaspis (A.) primaeva*. The L'Irlande Member has been assigned a Benthic Assemblage 6 position, and named the *Acernaspis* Community (which also includes the overlying Des Jean Member). Although the fauna is sparsely distributed, the total fauna includes species of *Acernaspis* (*Murphylops*), *Bolbinoessia*, *Monograptus*, as well as brachiopods (those previously cited as also occurring in the Des Jean Member, as well as *Homoospira?*, *Streptis* and *Triplesia*), conodonts and trilobites, and is distinctly Llandovery in age. Fossiliferous horizons within and above the clay-shales in the middle of the member are Telychian.



**Fig. 2** Columnar section of the Côte de la Surprise Member in the Portage river area (modified from Skidmore & Lespérance 1981). Fossil localities shown by arrowheads are those discussed in the text; numerous others are known. Insert shows location of Percé and the Portage river area (starred); Me.: Maine; N.B.: New Brunswick; Qué.: Québec.

Extensive and closely spaced sampling through the lowest 10m of the L'Irlande Member along the Deuxième Rang section stratotype has proven fruitless for conodonts (Nowlan 1983: 102).

The L'Irlande Member along the sea at White Head is locally faulted, but, nonetheless, 466 m are present (Lespérance *et al.* 1987). Strata below the middle clay-shale unit (faulted out along the sea) are less fossiliferous than those above, but an extensive trilobite fauna is known 35 m below the clay-shale (62-L31 or locality E of Lespérance in Ayrton *et al.* 1969: 479), with *Eoplectodonta cf. striatacostatus*, and the new atrypacid and athyridacid genera less than a metre above the trilobites (62-L32). A cephalon of *Acernaspis* sp. occurs 80 m (62-L41; erroneously referred to as a pygidium by Skidmore & Lespérance 1981: 37) below the clay-shales and a pygidium of *Acernaspis?* sp., with *Triplesia* sp., *E. cf. striatacostatus* and the two new genera previously quoted (62-L43 of Sheehan & Lespérance 1981: 255) 148 m below the clay-shales. Uncollectable pygidia of *Acernaspis* sp. occur below this last level, some 20–40 m above the base of the member. These are the lowest occurrences of Silurian fossils in the L'Irlande Member in the Percé area.

Lespérance (1985) has attempted to relate the *acuminatus* Zone, the base of the Silurian, to shelly sequences, and has concluded that *Acernaspis* is apparently the only taxon of Silurian

aspect, or previously known Silurian distribution, to originate at the *acuminatus* boundary. In view of the presence of the Hirnantian in the topmost Côte de la Surprise Member, the monotonous nature of the L'Irlande Member, and the absence of Ordovician fossils, it appears logical to assign the base of the L'Irlande Member to the Silurian.

### Conclusions

Although typical Hirnantian faunas are present in the Percé area, the base of the Silurian cannot be accurately positioned because of the lack of diagnostic graptolites, or, for that matter, other diagnostic taxa. It is surmised that the base of L'Irlande Member is of *acuminatus* Zone age, because *Acernaspis* occurs low in this member.

The Matapédia Group in the immediate Percé area thus consists, in the Ordovician, of deep-water communities (Grande Coupe beds) and shallower communities (Rouge, Birmingham and *Hirnantia* Community of the Côte de la Surprise Member), while the Silurian part reverts to deep-water communities, intermediate between the *Clorinda* and pelagic graptolite communities. The widely accepted glaciation at the end of the Ordovician, although of problematical length (Hambrey 1985), could explain, by rapid eustatic sea-level rise following melting of the ice-caps, the abrupt change from the Côte de Surprise mudstones to the thin-bedded calcilutites of the L'Irlande.

### Acknowledgements

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